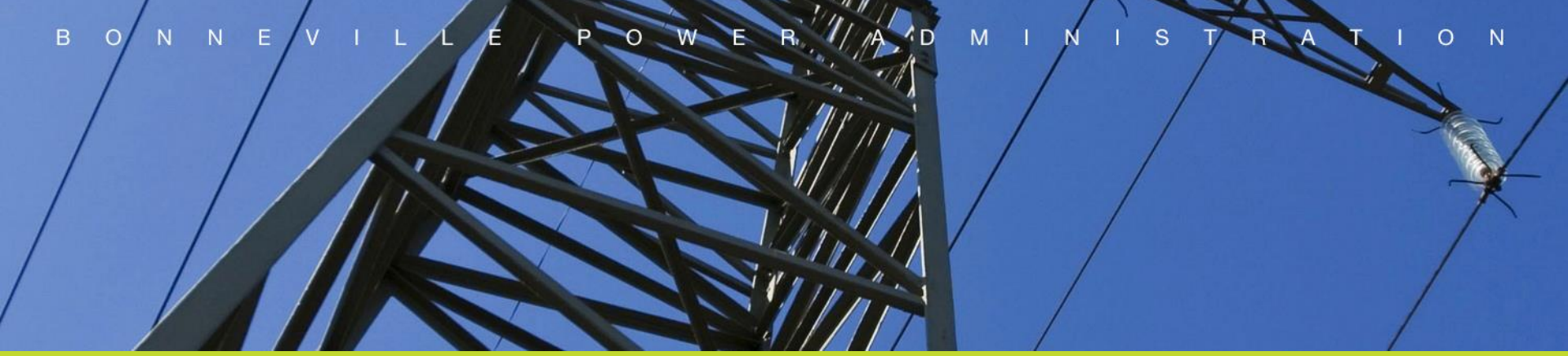


Bonneville Power Energy Imbalance Market Meeting

March 30, 2016

Future EIM Transmission Access Stakeholder Meetings in Portland at BPA's Rates Hearing Room:

Apr 13 – W
May 19 – TH
June 9 – TH
July 26 – T
Aug 16 - T
Sept 22 – TH
Oct 27 – TH
Nov 14 – M
Dec 20 - T

Welcome

- Logistics
- Introductions
- Agenda

Please sign-in by the entrance… Thank you

Agenda

- Overview and Discussion of:
  1. UL Limit Performance Monitoring
  2. Evaluation of Redirects
  3. Issues Log

Purpose of this Stakeholder Process

- Develop a risks and controls framework to assess risks to customers' existing and future transmission usage rights and evaluate the adequacy of existing BPA controls to protect those rights.

- Transparently develop a risk mitigation and control framework that ensures BPA meets its obligations and protects customer rights.

- Provide information to aid potential EIM Entities seeking to understand how they might be able to use their transmission rights on the Federal Columbia River Transmission System (FCRTS) if they were to join the California Independent System Operator Energy Imbalance Market (CAISO EIM).

Objectives

- Build understanding of EIM participant transmission use.
- Identify and manage risks for near-term EIM participant transmission use.
- Inform future planning and proceedings through a transparent process.
- Develop policies on the use of federal transmission for intra-hour operations.
- Consider the issues on an integrated, rather than case-by-case, basis.

Deliverables from this process

- Articulate a control framework and plan for monitoring and improvement.
  - Manage operational and commercial risks.
  - Identify areas for improvement.
- Validate effectiveness of EIM control framework.
  - Identify gaps and resolve as needed.
- Maintain a transparent set of rules for customers to use their transmission rights for EIM participation.

Upper/Lower Limit Performance Monitoring

Topics

- Overview
- Definitions
- Network Model
- Control Overview
- Background
- How we monitor performance
- Actual performance
- Summary
- Questions

Overview

- BPA established reliability requirements in order to protect the transmission system from intolerable movements of participating Pacificorp (PAC) generators as they are dispatched by the CAISO.
- The EIM Market Operator (CAISO) is responsible for applying a set of controls such that BPA's transmission system is protected and the quality of transmission service to other BPA customers is not degraded.
- The set of controls is further supported by the sharing of real time information between BPA and the CAISO and offers BPA situational awareness of pending and actual actions that affect the transmission system.

Definitions

- RTD - Real Time Dispatch (i.e. 5 minute market)
- RTPD - Real Time Pre-Dispatch (i.e. 15 minute market)
- Dispatch Operating Target (DOT) – dispatch direction to a participating resource (binding and advisory).
- Rate of Change (ROC) “Market flow” – 5 minute change in flowgate flow due to coincidental impact of certain EIM resources.
- Generation Shift Factor (GSF) – flow contribution of a generator (resource) on a flowgate, calculated by State Estimator (SE) software.

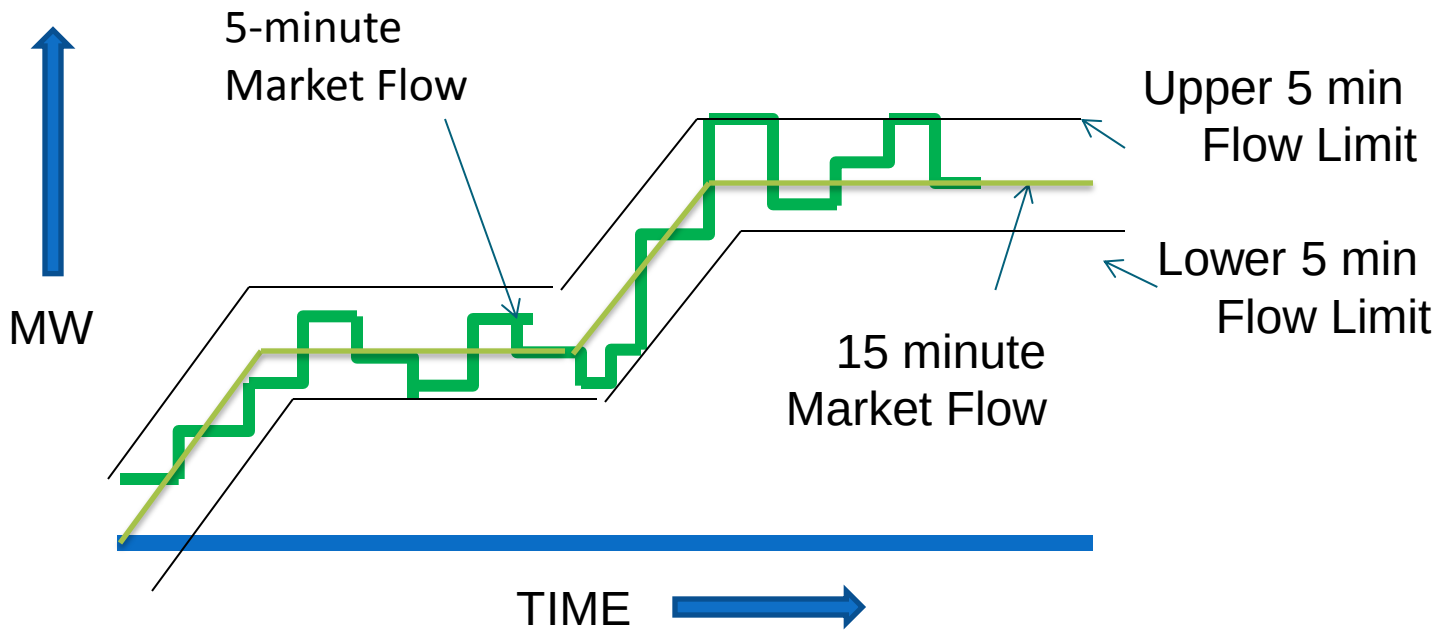
Network Model

- An accurate network model is essential.
- Real-time validation of the CAISO State Estimator (SE) and BPA's SE is not practical at this time.
  - Due to differences in the software tools, frequency of updates, naming conventions, communication of default switch positions etc.
- BPA has been sampling the results of the CAISO SE and comparing them to BPA's SE.
  - Validates that flowgates and outages are modeled accurately.

Control Overview

- Focuses on the market flow impact due to the RTD.
  - BPA established market flow limits (plus and minus) for allowable flow impacts on a set of monitored flowgates.
  - The limits constrain the market solution at times.
  - On the initiation of a flowgate curtailment, the corresponding flowgate limit is set to zero.
  - As flows approach the System Operating Limit (SOL), the limits may be reduced to further constrain EIM dispatches.
  - Measured relative to the RTPD (15 minute market).
  - Applied, per resource, in periods when CAISO is directing resources that are “online” (being bid).

Control Overview – Cont'd



Background

- BPA receives from the CAISO:
  - Load forecast and Net Scheduled Interchange for CAISO, PACW, and PACE (5 minute data).
  - Binding and advisory “market flow” for 11 BPA flowgates and the COI (5 minute and 15 minute markets).
  - Dispatch Operating Targets (DOTs) for the real time (5 minute) and 15 minute intervals (advisory and binding) for each resource that impacts market flow.
  - Market status for each resource (5 minute advisory and binding).
  - State estimator calculated generation shift factors for each resource, per flowgate.
  - BPA receives ~ 100,000 data points per day, will increase substantially as new entities join the EIM.

  As other entities enter the CAISO EIM, BPA will require similar information.

Background – Cont'd

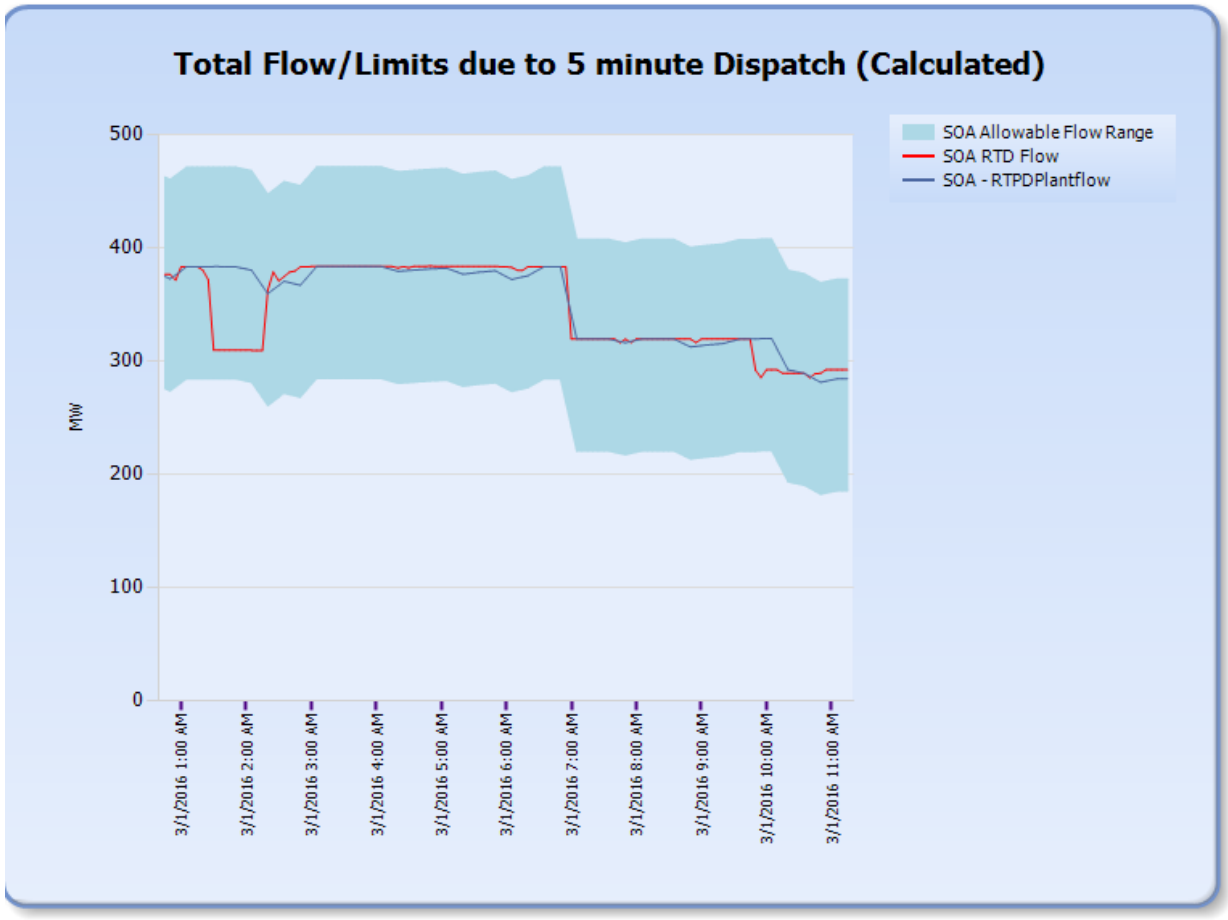
- BPA sends to the CAISO (for 11 flowgates):
  - Upper and lower 5 minute market flow limits.
  - Flowgate flows and real time SOLs.

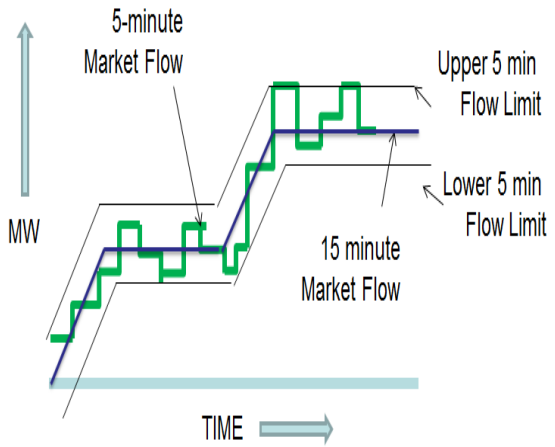
How We Monitor Performance

- Compare the market flow to the flowgate upper and lower limits.
- Assure that the product of the resource dispatch and the GSFs match the market flow reported by the CAISO.

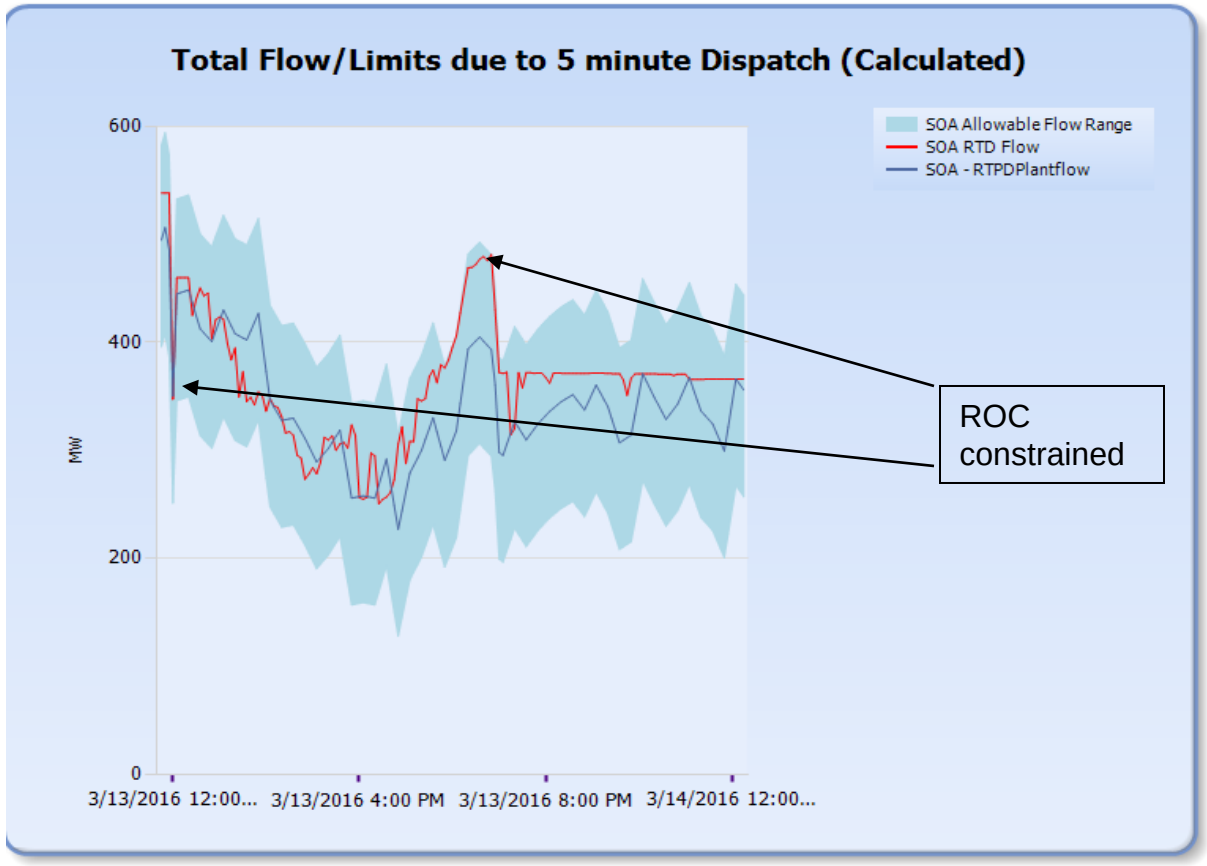
Performance Monitoring

Are the controls working?





Actual Performance
Effectively Limiting Market Dispatches



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Actual Performance
Operating within constraints (frequency *)

- Measured for each 5 minute market run.
  - Operating within the market flow upper and lower limits 99.9%.
  - Averages to one 5 minute exceedance every 3.5 days (per flowgate).
  - No observed reliability impacts.

* Number of 5 minute intervals

Summary

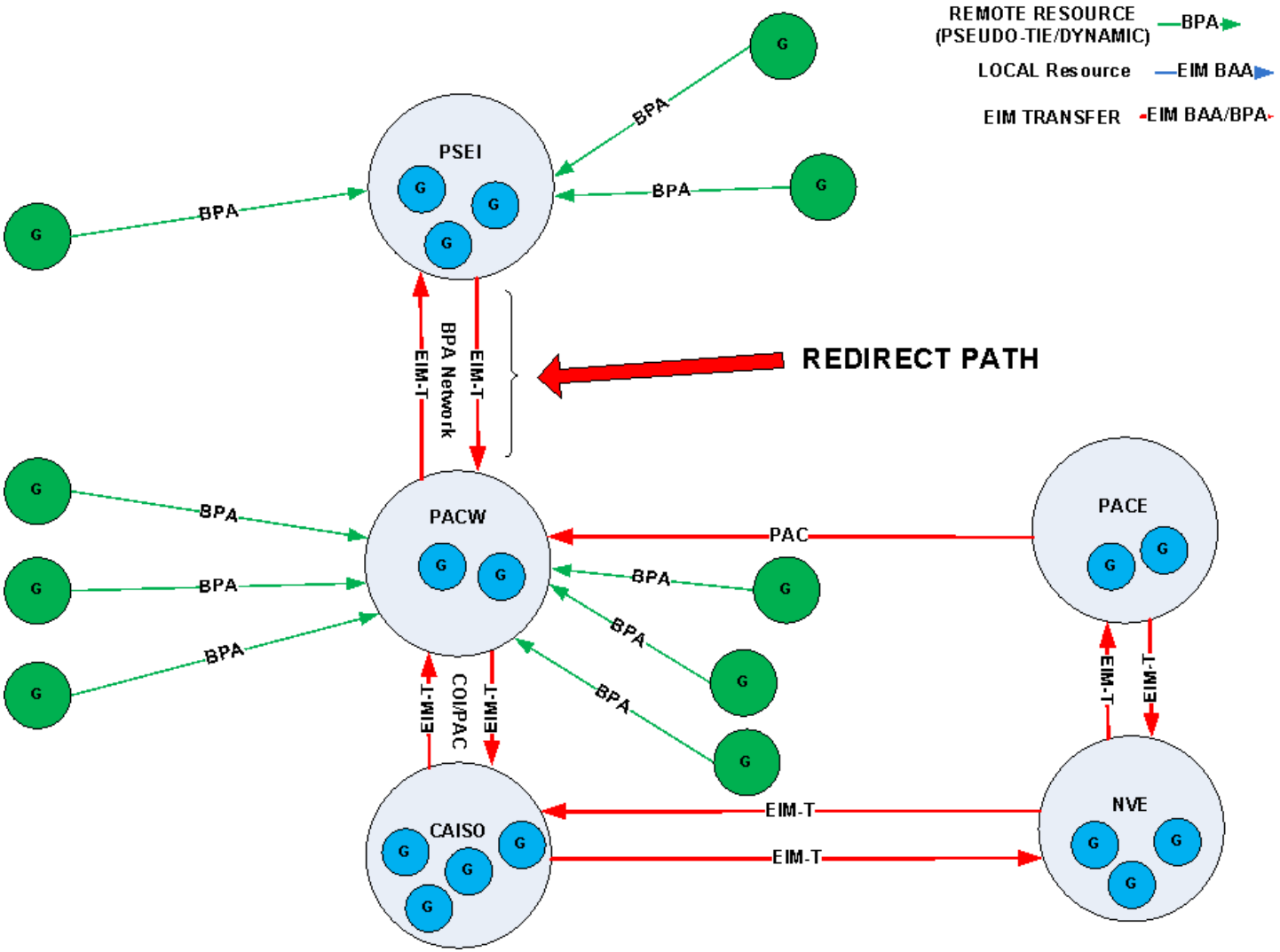
- BPA has observed no operational or reliability impacts.
- Substantial improvement in BPA's visibility of activity on the transmission system.
  - Will continue to improve as other entities join the EIM.
- CAISO personnel, processes, and systems are doing a good job in operating within the ROC limits.

Questions?

Evaluation of Redirects

- BPA has received questions about ATC impacts of the use of BPA transmission for EIM participation.
- Such transmission use is subject to the same Available Transmission Capability as any other use.
- Current use is on Firm Point-to-Point (PTP) reservations that have been evaluated for ATC impacts.
  - The only new schedule for PSE go-live is the EIM Transfer between the PSEI and PACW Balancing Authority Areas.
  - PSEI submitted requests for Firm Redirects that were evaluated and approved based on our standard processes.
- BPA has not identified the need for any unique controls or processes to manage ATC impacts of customers using BPA transmission for EIM Participation.

Overview


REMOTE RESOURCE (PSEUDO-TIE/DYNAMIC)
BPA
LOCAL Resource
EIM BAA
EIM TRANSFER
EIM BAA/BPA
PSEI
PACW
PACE
CAISO
NVE
G
BPA
BPA Network
EIM-T
REDIRECT PATH
PAC
COI/PAC

What's a Redirect?

- Redirects are the mechanism for a PTP transmission customer to change their path of service
  - Customers may change just the POR or POD or both
- Evaluation of a redirect credits the ATC needs of the new path (child), with ATC already encumbered on the old path (parent)
  - Source/Sink is used for bus mapping on LT TSRs
  - POR/POD is used for bus mapping on ST TSRs
- Redirects can be approved if ATC needs can be met by the ATC encumbered by the parent and/or unencumbered ATC in inventory
  - Long term redirects may be subject to a subgrid check

Evaluation

- During evaluation both the parent and the child impacts are calculated by PTDF analysis
  - (POR PTDF less POD PTDF)*demand
- De Minimis Test 1 is applied separately to the parent and the child, not the difference of the two
  - If the impact is 10% of the demand and less than 10MW, De Minimis test 1 applies
- Only non De Minimis impacts on the parent may be used to credit the child
- If the non De Minimis impacts of the parent/child is greater than 0.80 and less than 10MW, De Minimis Test 2 applies (for LT TSRs only)

Example of Evaluation of a LTF TSR

- 50MW Redirect request
- Flowgate A has non de minimis impacts on parent and child, so the inventory need is child impact less parent impact.
- Flowgate B has a non de minimis impact on the child and a de minimis impact on the parent. In this case the parent cannot credit the child.
- Flowgate C has a de minimis impact on the child, so it doesn't matter what the parent brings.
- Flowgate D has two non de minimis impacts. The parent doesn't bring enough to satisfy the child; however, this passes De Minimis Test 2 since parent/child is greater than 0.80 and parent less child is less than or equal to 10MW.

	Flowgate A	Flowgate B	Flowgate C	Flowgate D
CHILD POR	-0.0123	-0.0123	-0.0254	-0.0163
CHILD POD	-0.2242	-0.2242	-0.0703	-0.6487
	10.595	10.595	2.245	31.62
PARENT POR	-0.1445	-0.0254	-0.033	-0.033
PARENT POD	-0.2242	-0.0703	-0.6487	-0.6487
	3.985	2.245	30.785	30.785
NET IMPACT	6.61	10.595	0 (DM TEST 1)	0 (DM TEST 2)

Questions?

Issues Log
(Separate Attachment)

Issue Resolution and Next Steps

- BPA has presented on all of the major issues identified in the Issues Log.
- BPA believes it has developed and implemented a control framework that effectively manages any commercial or reliability risks from customers using their FCRTS rights for EIM participation.
- BPA believes is has articulated these controls and that they are resolved.
- We ask for comment on whether further discussion would be beneficial and if monthly meetings are still required.
- BPA still plans to have stakeholder meeting to discuss performance and market simulation results prior to new PSE's go-live date.

Questions….

Russ Mantifel: 360-418-2827

techforum@bpa.gov

Future Stakeholder Meetings in Portland at BPA's Rates Hearing Room:

- ~~Mar 30 – W~~
- Apr 13 – W
- May 19 – TH
- June 9 – TH
- July 26 – T
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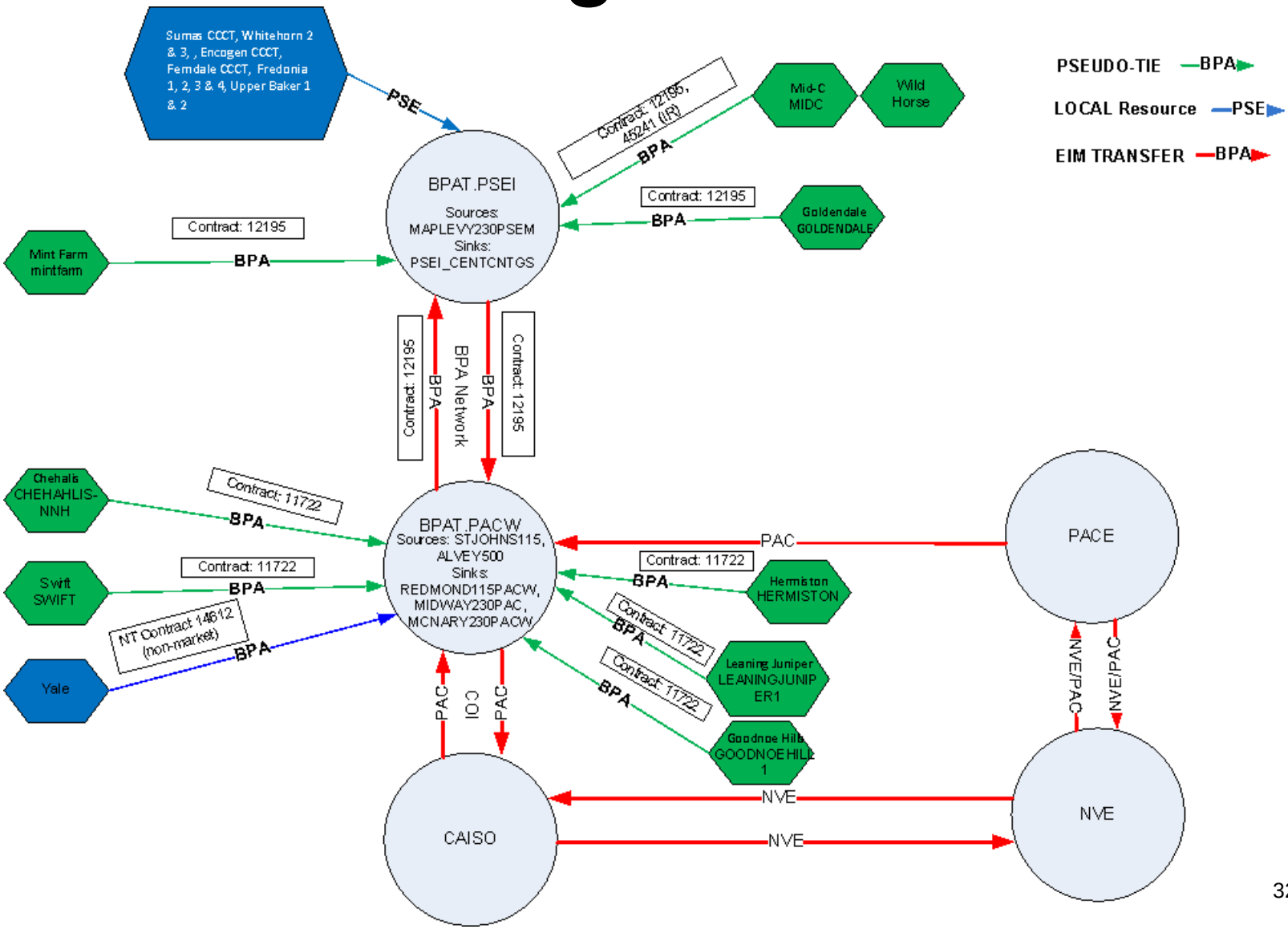
Appendix

EIM Bubble Diagram



Description of EIM Movement

PSEUDO-TIE —BPA▶

Delivery of PSE/PAC generator to the PSE BA over Firm BPA transmission via a PSEUDO-TIE tag. These tags and deliveries exist today for PSE/PAC's BA operation.

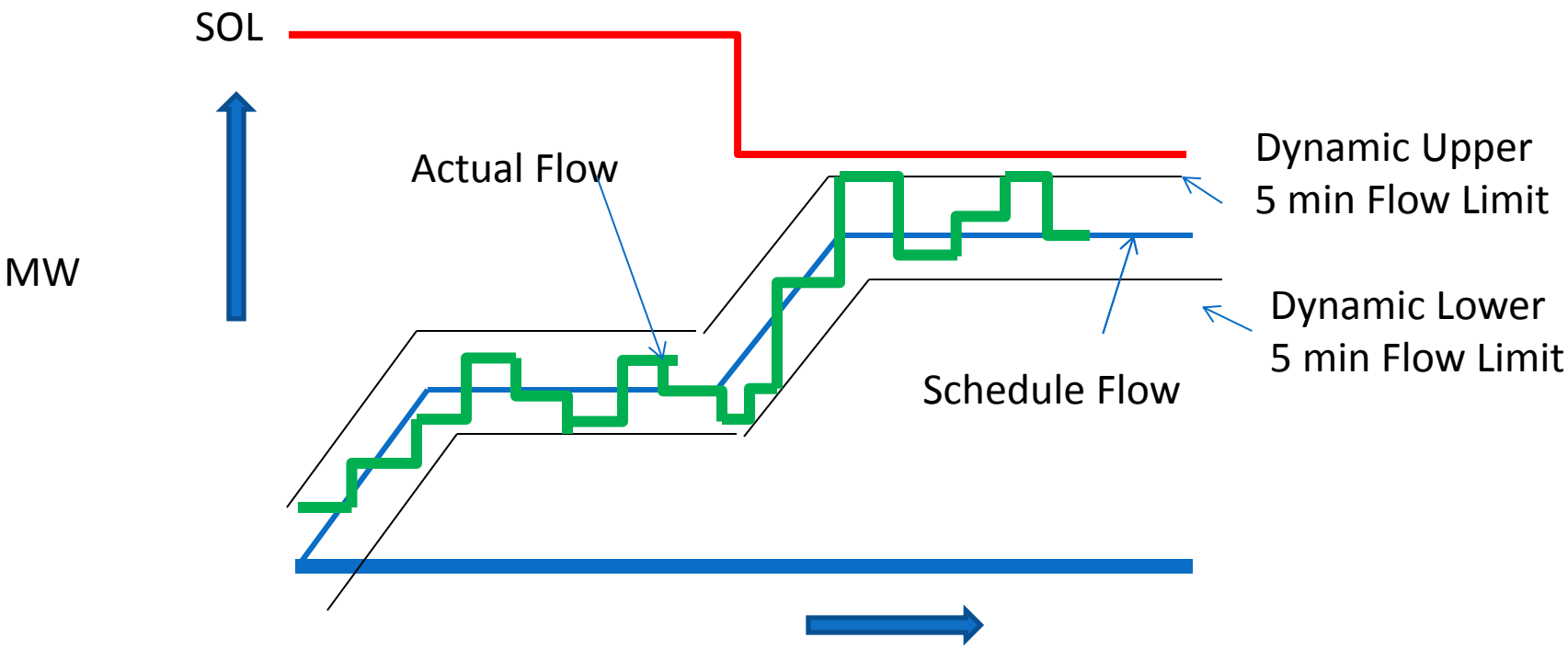
LOCAL Resource —PSE▶

Generation that is "local" to the PSE/PAC BAs (i.e. it does not require BPA transmission to be delivered to PSE/PAC load).

EIM TRANSFER —BPA▶

EIM Transfers represent the net market dispatch among the EIM Entity BAAs. These transfers exist today for PAC, but PAC uses its own transmission for these transfers. They are tagged as system to system and use NORMAL tags for 15-Minute dispatches and DYNAMIC tags for 5-minute dispatches.

Upper and Lower Limit Overview



Upper/Lower Limits are

Data Transfer in Support of Upper and Lower Limits

- BPA sends effective Upper and Lower Limits to the CAISO in real time.
- BPA receives data on the EIM in real-time
  - Advisory 5-minute and 15-minute dispatches
  - Binding 5-minute and 15-minute dispatches
  - Forecasted 5-minute and 15-minute Market Flow
  - Binding 5-minute and 15-minute Market Flow
  - Load forecasts for EIM Balancing Authority Areas
  - Unit status
  - Shift factors for EIM Participating Resources impacts on BPA's flowgates
  - Net Scheduled Interchange and load for EIM Balancing Authority Areas and CAISO

Schedule

Short-term Schedule: This process timeline is based on the go-live timeline for PSE.

	Start	Finish
BPA's EIM Participant - Transmission Access - Short-Term - Project Schedule	6/1/2015	10/3/2016
Section 23/EIM Transfer Issues	completed	
Use of Network (WECC) Model - CAISO accurately modeled our network	on-going w/ quarterly updates	
Stakeholder Process on EIM Implementation	8/17/2015	7/1/2016
Reimbursable Agreement	6/1/2015	12/11/2015
UL Limit Design	6/1/2015	9/15/2016
UL Limit Calculations	6/1/2015	7/1/2016
Data flows and Schedules	9/28/2015	9/28/2016
Provide Mechanism for how to transfer data (BPA--> CAISO)	10/1/2015	7/13/2016
Provide Mechanism for how to transfer data (CAISO --> BPA)	9/28/2015	9/28/2016
Market Constraints modeling	1/17/2016	3/28/2016
Study/Analysis of EIM and UL Limit Performance	1/1/2016	8/1/2016
Market Simulation Testing and Remediation	1/1/2016	9/1/2016
Market Simulation Begins	5/2/2016	9/1/2016
Production Readiness	Pre-PSE FERC filing	10/1/2016

Long-term Schedule: Allows BPA to develop new Business Practices that all EIM participants will follow. It will take into account the changing northwestern market.